

CLAIMS

1. An image sensor comprising a plurality of pixels, each pixel comprising:
a light sensor element (12); a sensor voltage across the element
varying depending on the light incident on the element (12);
a voltage amplifier (16) having gain magnitude greater than 1; and
a sampling capacitor (18) charged by the voltage amplifier,
wherein the voltage amplifier comprises first (40) and second (38)
transistors in series, the input to the voltage amplifier being provided to the
gate of the first transistor (40), and the output being defined by the junction
between the first and second transistors (40,38),
and wherein each pixel further comprises a third transistor (49), the gate
of the third transistor being connected to one terminal of the light sensor
element (12), and the source of the third transistor (49) being connected to the
gate of the first transistor (40).
2. An image sensor as claimed in claim 1, wherein each pixel further
comprises a pixel storage capacitor (14) connected to the light sensor element
(12).
3. An image sensor as claimed in claim 2, wherein the capacitance of the
sampling capacitor (18) is less than 10 times the capacitance of the pixel
storage capacitor (14).
4. An image sensor as claimed in claim 3, wherein the capacitance of the
sampling capacitor (18) is less than 2 times the capacitance of the pixel
storage capacitor (14).
5. An image sensor as claimed in claim 4, wherein the capacitance of the
sampling capacitor (18) is approximately equal to the capacitance of the pixel
storage capacitor (14).

6. An image sensor as claimed in claim 3, 4 or 5, wherein the capacitance of the sampling capacitor (18) is in the range 0.5pF to 3pF, and the capacitance of the pixel storage capacitor (14) is in the range 0.5pF to 3pF.

7. An image sensor as claimed in claim 1, wherein the capacitance of the sampling capacitor (18) is less than 10 times a self-capacitance of the light sensor element (12).

8. An image sensor as claimed in claim 7, wherein the capacitance of the sampling capacitor (18) is less than 2 times the self-capacitance of the light sensor element (12).

9. An image sensor as claimed in claim 7 or 8, wherein the capacitance of the sampling capacitor (18) is in the range 0.5pF to 3pF, and the self-capacitance of light sensor (12) is in the range 0.5pF to 3pF.

10. An image sensor as claimed in any preceding claim, wherein the gain magnitude of the voltage amplifier (16) is in the range 2 to 5.

11. An image sensor as claimed in any preceding claim, wherein a bias voltage (44) is connected to the gate of the second transistor (38).

12. An image sensor as claimed in claim 11, wherein the output of the voltage amplifier (16) is connected to one terminal of the sampling capacitor (18), the other terminal of the sampling capacitor (18) being connected to the pixel output through an output switch (22;34).

13. An image sensor as claimed in any preceding claim wherein each pixel further comprises an input switch (20;30) for applying a fixed potential (V_{reset}) across the light sensor element.

14. A method of measuring light intensity of an image to be detected using a plurality of light sensor elements (12) each forming a pixel of an image sensor, a sensor voltage (V_{in}) across the elements varying depending on the light incident on the elements, the method comprising:

providing the sensor voltage (V_{in}) to an in-pixel voltage amplifier through a source-follower buffer transistor;

amplifying the voltage provided by the source-follower buffer transistor using the in-pixel voltage amplifier (16) having a gain magnitude greater than 1;

charging a sampling capacitor (18) with the amplified voltage (V_{out}) and measuring the flow of charge required to charge the sampling capacitor (18).

15. A method as claimed in claim 14, wherein a reset operation is carried out before amplifying the voltage provided by the source-follower buffer transistor, the reset operation comprising applying a known potential to one terminal of the sampling capacitor (18) and applying a known potential (V_{reset}) across the sensor element, the amplified voltage (V_{out}) being subsequently applied to the other terminal of the sampling capacitor (18).

16. A method as claimed in claim 14 or 15, wherein the capacitance of the sampling capacitor (18) is less than 10 times the capacitance of a pixel storage capacitor (14) of the pixel.

17. A method as claimed in claim 16, wherein the capacitance of the sampling capacitor (18) is less than 2 times the capacitance of the pixel storage capacitor (14).

18. A method as claimed in claim 17, wherein the capacitance of the sampling capacitor (18) is approximately equal to the capacitance of the pixel storage capacitor (14).

19. A method as claimed in any one of claims 14 to 18, wherein the gain magnitude of the voltage amplifier (16) is in the range 2 to 5.